REMARKS

The present paper is in response to the final Office Action of February 25, 2003 and constitutes the submission required under 37 C.F.R. § 1.114.

The undersigned attorney appreciates the Examiner's sending via facsimile on August 21, 2003 the translation of Toray Industries, JP No. 0790747 and Smith et al., U.S. Patent No. 5,378,019, which documents were used to reject claims but were not provided with the Office Action of February 25, 2003.

Claims 9-21 are now in the case and include new independent claim 17 and dependent claims 18-21.

As discussed in the subject application, an object of the present invention is to reduce significantly the weight and thickness (volume) of an air bag while maintaining the mechanical properties of the air bag as well as durability against long term aging. The basis weight and thickness of the fabric for an improved air bag are reduced by about 20%, preferably 30% or more, when compared with a conventional base fabric used in a conventional air bag. (See application, page 3, line 30 to page 4, line 19.)

In the present invention, a significant mechanical property of the fabric is tensile work. Tensile work at break of the woven fabric forming the air bag is more relevant from a design standpoint than the tensile strength at break. In accordance with the applicants' observation, the dynamic load exerted on the air bag is larger at the stage when the air bag is projected forward to a maximum extent than at the stage when the air bag inflates to a maximum extent and restrains the occupant. (See application, page 8, line 22 to page 9, line 1.) Tensile work of a fabric is generally correlated to the basis weight of the woven fabric if the kind of yarn is specified. It is significant in the

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present invention that an unnecessarily large tensile work at break is contradictory because weight reduction and compactness of the present air bag are important requisites.

The woven fabric of the present invention is specified in terms of a parameter, weave fineness, which is a product of total fineness of warp or weft multiplied by weave density, the product being 16000 decitex•end/2.54 cm or less. The value range of the load at 15% elongation of the fabric is specified in order to obtain a pliable air bag that prevents occurrence of injury of the vehicle occupant at impact. The mechanical properties are maintained even after the air bag has been exposed to prolonged periods of heat-aging, wet heat-aging, and ozone-aging.

Claims 10, 11, 13, and 15 stand rejected in a new rejection under 35 U.S.C. § 103(a) as being unpatentable over Toray Industries ("Toray") (JP 0790747). This rejection is respectfully traversed both as to these claims, as well as new claims 17-21.

With reference to the translation of Toray, this document relates to a base fabric for use in an uncoated air bag which is light in weight, flexible, excellent in stowability and fireproof properties, while maintaining mechanical properties. Based on the embodiments described in the Examples and Comparative Examples of Toray and the description in paragraphs [0023] and [0027] to [0029] of the translation, the invention of Toray appears directed to a fabric formed of nylon or polyethylene terephthalate yarn having a yarn size greater than 210 denier. Toray's base fabric has improved mechanical properties, particularly tear strength, air-permeability and flame-proofing, while being light in weight, with good softness and stowability and, accordingly, can be used as a base fabric for an uncoated air bag in place of a rubber-coated base fabric.

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In this connection, reference is especially made to paragraph [0028] which states that the desirable lower limit of total yarn fineness of the weaving yarn is 210 denier in order to satisfy the mechanical properties.

In Examples 1 to 4 and Comparative Examples 1 to 3 of Tables 1 and 2 of Toray, the fabrics are formed by weaving nylon 66 filamentary yarns containing a copper compound (80 ppm) in the presence of potassium iodide on a water jet loom, the multifilament yarns having a total yarn size equal to or exceeding 315 denier. See the (D-fil) and (d) lines: 420/144 filaments (2.9d); 420 denier/216 filaments (1.9d), 315 denier/144 filaments (2.2d), and 420 denier/72 filaments (5.8d). The multifilament yarns in Table 1 are constituted of a plurality of single filaments having a denier of 1.9 to 2.9.

While the basis fabric of Toray satisfies certain features of claim 10, differences between this claim and Toray were identified by the Examiner and are significant and readily distinguish claims 10, 11, 13, and 15.

Attached Tables A and B and the Supplement to Tables A and B: Definitions have been prepared by the assignee of the subject invention and are submitted for the Examiner's perusal. In these two tables, the fabrics of the present invention are set out in Examples and Comparative Examples of Table A, and the fabrics of Toray are set out in Examples and Comparative Examples of Table B. In these tables, the respective features are compared with respect to weaving yarns, weave fineness, cover factor, tensile work of fabric, and tensile work/g fabric.

In the tables, the data are estimated data obtained by calculation based on the data expressly described in the respective Examples in the subject application and the

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Toray document (e.g., strength/3 cm data of Toray is converted into strength/2.54 cm; yarn (filament) size in denier is converted to decitex).

As understood by a comparison of Tables A and B, it is submitted that the fabrics of the Toray Examples and Comparative Examples clearly have different levels of weave fineness. These levels are completely out of the scope of a claimed feature of the subject invention, even though the fabrics have almost the same levels of cover-factor values. This distinct difference in fabric structure in terms of weave fineness between the present fabrics and Toray fabrics is recited in claim 10 and new claim 17, i.e., "wherein the product of fineness of the warp or weft of the fabric multiplied by the weave density of the fabric being less than 16000 decitex•end or pick, respectively, /2.54 cm."

It is further submitted the value of weave fineness is directly correlated with basis of weight of a fabric and generally correlated to tensile work of the fabric which clearly suggests that the fabrics of the present invention are formed based on a fabric design concept completely different from that of the Toray fabrics.

Weight reduction and compactness of folded air bags are an important object of the present invention. This object is achieved by selecting a woven fabric in reference to its weave fineness so that the fabric has an appropriate tensile work at break. In claim 10, as well as in claim 9, the last limitation sets forth a condition that excludes a fabric having an unnecessarily large tensile work at break. (See application, page 9, lines 12 to 20.) Although the Examiner admits that Toray does not disclose a "tensile work at break of 7000 to 30,000N%/2.54 cm" specified in claims 10 and 17, it is submitted the reference in Toray to a cover factor of 2000 or more does not lead

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someone skilled in the art to the design of the claimed fabric having the features admittedly absent from claim 10 and thus claim 17. It does not become a question of "routine optimization" in such case because the basic structure is not taught, or made obvious or attainable to someone skilled in the art based on the Toray disclosure.

In claim 17 and its dependent claims 18-21, the limitation that the yarns have a yarn fineness in the range of 66 to 167 decitex has replaced in claims 9 and 10 the limitation that each filament in the yarns has a fineness in the range of 1 to 3.3 decitex. This feature alone distinguishes Toray and makes the assertion of "routine optimization" moot. Toray's base fabric cannot be formed practically of multifilament yarn having a yarn size smaller than 210 denier. In [0028] of the translation, Toray states that to satisfy the mechanical properties of a base fabric from a practical standpoint, for a minimum, it is desirable that the fineness of the fiber is 210 denier. To engage in "routine optimization" below this level and especially down to the claimed level of 66 to 167 decitex is not only not taught by Toray but essentially taught against. Thus, someone skilled in the art met with this teaching would not seek to vary the fineness of yarn below this level because of the concern of whether the mechanical properties of the base fabric could be achieved.

Furthermore, as discussed in prior Amendments, the facts and reasoning in the cited Boesch and Slaney case are inapposite to the facts at hand for a number of reasons, including, but not limited to, the fact that there is not the requisite overlap in the identified limitations missing from Toray which overlap must be present before one can resort to "routine optimization." The MPEP does not authorize an Examiner to limit examination by dismissing any claimed structure not uncovered in the prior art as

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essentially irrelevant which is what has been done in the present case under the guise of "routine optimization."

Claims 9, 14, and 16 stand rejected as unpatentable over Toray in view of the newly-cited patent to Smith et al. ("Smith") U.S. Patent No. 5,378,019. This rejection is also respectfully traversed. The shortcomings of Toray have been discussed above regarding claim 10 and apply equally here for claim 9. The addition of Smith, assuming arguendo that it is combinable with Toray, does not correct these shortcomings. Furthermore, Smith's air bag is formed preferably of a neoprene backing layer. Because the Toray air bag employs a base fabric for an uncoated air bag, it cannot be formed of a neoprene coated fabric. An attempt to combine Smith with Toray would be contrary to Toray's teachings and unsupportable for this reason alone.

Claim 12 stands rejected under 35 U.S.C. § 103(a) over Toray in view of Mizuki et al. ("Mizuki"). This rejection is also respectfully traversed. Mizuki discusses the well-known factor of birefringence, but this discussion does correct the shortcomings of Toray identified and discussed earlier. Further, Mizuki does not teach the requirement in claim 12 that the birefringence of the weft is larger than that of the warp. The Examiner's solution is again "routine optimization" until the birefringence of the weft is larger than that of the warp. Not only does this approach deprecate the invention, it overlooks completely the technical significance of this claimed feature, namely, to make the mechanical properties substantially the same in the warp and weft directions of the fabric. See application, page 10, lines 26 to 36. While it is plausible that Toray would have birefringence as high as needed for obtaining a high-strength yarn, the technical relationship of warp yarn to weft yarn, as recited in claim 12, is neither taught nor made

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obvious by either Toray or Mizuki. Additionally, neither of their respective teachings lays a groundwork for invoking the "routine optimization" solution of the Examiner for correcting the deficiencies of a reference.

Early consideration and allowance of claims 9-21 are earnestly solicited.

Please grant any extensions of time required to enter this response and charge any additional required fees to our deposit account 06-0916.

Respectfully submitted,

FINNEGAN, HENDERSON, FARABOW, GARRETT & DUNNER, L.L.P.

Dated: August 25, 2003

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Attachments: Tables A and B and Supplement to Tables A and B: Definitions

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Table A Present Examples (EX) and Comparative Examples (CE)

	EX1		EX2		EX3		EX4		EX5		EX6		CE1		CE2		CE3		CE4	
Fabrics																				
Weave density ends/2.54 cm; picks/2.54 cm	95	93	95	93	95	93	90	98	94	94	142	142	95	93	95	93	192	190	78	75
Strength at break kg/3 cm N/2.54 cm	1010	930	900	850	770	740	963	983	951	941	760	740	998	872	1000	871	564	559	1326	1275
Tensile work (Estimated.) N·%/2.54 cm	17675	12555	20250	14450	20790	15910	16853	13271	19020	12704	14060	9620	7984	6540	8000	6097	1974	4752	13260	19125
(measured value)	20500	13500	20600	14500	17500	13600	17800	14900	20500	14000	12500	8000	20000	12000	20500	12000	6000	5900	30000	26000
Tensile work/g·fabric N·%·m^2/2.54 cm/g	303	220	347	253	356	279	305	220	329	220	322	221	137	114	137	107	47	113	185	278
Cover factor	2224		2224		2224		2224		2224		2376		2224		2224		2701		2243	
Weave fineness dtex·end/2.54 cm; dtex·picks/2.54 cm	14820	14508	14820	14508	14820	14508	14040	15288	14664	14664	11076	11076	14820	14508	14820	14508	10752	10640	18174	17475
Elongation at break %	35	27	45	34	54	43	35	27	40	27	37	26	16	15	16	14	7	17	20	30
Basis of weight (measured) g/m^2	125	125	125	125	125	125	125	125	125	125	94	94	125	125	125	125	92	92	152	152
Basis of weight (estimated) g/m^2	115		115		115		115		115		87		115		115		84		140	
(warp, weft)	58	57	58	57	58	57	55	60	58	58	44	44	58	57	58	57	42	42	72	69
Yarns (warp, weft)																				
yarn size dtex	156	156	156	156	156	156	156	156	156	156	78	78	156	156	156	156	56	56	233	233
denier	140	140	140	140	140	140	140	140	140	140	70	70	140	140	140	140	50	50	215	215
Fineness of single filament dtex/filament	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	1.6	1.6	6.7	6.7

Table B Toray Examples (TE) and Comparative Examples (TC)

	TE1		TE2		TE3		TE4		TE5		TC1		TC2		TC3		TC4	
Fabrics																		
Weave density ends/2.54 cm; picks/2.54 cm	55	55	55	55	55	55	70	70	66	66	46	46	55	55	55	55	66	66
Strength at break kg/3 cm	203	210	190	188	208	202	220	215	201	192	212	210	245	232	240	233	211	201
N/2.54 cm	1686	1744	1578	1561	1727	1677	1827	1785	1669	1594	1760	1744	2034	1926	1993	1935	1752	1669
Tensile work (estimated.) N·%/2.54 cm	26968	24411	26819	22634	29359	23481	29226	24992	25033	19130	26403	22667	35599	28894	35869	29986	25403	20027
(measured value)																		
Tensile work/g·fabric N·%·m²/2.54 cm/g	265	240	264	222	288	231	303	259	205	157	310	266	350	284	352	295	208	164
Cover factor	2257		2257		2260		2489		2705		1890		2260		2257		2705	
Weave fineness dtex·end/2.54 cm; dtex·picks/2.54 cm	25850	25850	25850	25850	25850	25850	24500	24500	31020	31020	21620	21620	25850	25850	25850	25850	31020	31020
Elongation at break %	32	28	34	29	34	28	32	28	30	24	30	26	35	30	36	31	29	24
Basis of weight (measured) g/m²																		
Basis of weight (estimated) g/m²	204		204		204		193		244		170		204		204		244	
(warp, weft)	102	102	102	102	102	102	96	96	122	122	85	85	102	102	102	102	122	122
Yarns (warp, weft)																		
yarn size dtex	470	470	470	470	470	470	350	350	470	470	470	470	470	470	470	470	470	470
denier	421	421	421	421	422	422	316	316	420	420	422	422	422	422	421	421	420	420
Fineness of single filament dtex/filament	3.3	3.3	3.3	3.3	3.3	3.3	2.4	2.4	2.2	2.2	6.5	6.5	6.5	6.5	3.3	3.3	2.2	2.2

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Supplement to Tables A and B: Definitions

1) Tensile work (=energy) converted (per 2.54 cm width of fabric)

(Strength of fabric * tensile elongation)/2
---- Formula (1)

Tensile work (Estimated) corresponds to an area below stress-strain curve from the initial point of the curve to the point where the fabric break, and in Table A and B the value is estimated value obtained by calculating the area of a triangle surrounded by the three straight lines connecting the initial point of stress-strain curve, breaking point of the curve and the base line of the stress-strain curve (see Fig. 1 of the drawing).

2) Weight of fabric estimated (=basis of weight)

Weight of warp yarn [weave density × weight of warp yarn] + Weight of weft yarn [Weave density × Weight of weft yarn] ---- Formula (1)

Crimp ratio of woven yarns are neglected.

3) Tensile work (estimated) of fabric/weight

The value of tensile work (estimated) is calculated based on the value of tensile work by Formula (1) and the weight of fabric by formula (2).

The weight in the formula is related to 'm' in '$1/2 \times mv^2$' which represents a dissipated energy of air bag when the air bag is at deployment. Work converted relates to

pressure at burst of an air bag. The dissipated work (energy) is absorbed by the inflating gas pressure. Accordingly, a value of work estimated/weight can be a parameter capable of evaluating resistance to bursting pressure of a fabric regardless of basis of weight of fabric.